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positioning the first diffraction grating pattern on the substrate and the second diffraction grating pattern to be spaced with respect to each other, across an air space, by engaging the alignment pattern of the substrate with the alignment pattern of the mold.

12. An optical system having a diffractive optical element as manufactured in accordance with the method recited in Claim 11.

13. (Amended) An optical system having a diffractive optical element according to Claim 1.

14. An optical system having a diffractive optical element as manufactured in accordance with the method recited in Claim 9.

REMARKS

In view of the following remarks, Applicants request favorable reconsideration of the above-identified application.

Claims 1-14 are now pending in this application, with Claims 1-4, 7, 8 and 11 being independent. By this Amendment, Applicants have canceled Claims 15-20 and amended Claims 1-11 and 13.

The Office Action indicates that, should Claims 1, 2, 6, 7 and 8 be found allowable, Claims 15-20 would be objected to under 37 C.F.R. § 1.75. Applicants respectfully submit that this issue is now moot in view of the cancellation of Claims 15-20.

Claims 1-9 and 13-20 stand rejected under 35 U.S.C. § 103 over U.S. Patent No. 5,847,877 (Imamura, et al.) in view of U.S. Patent No. 5,208,700 (Harris, et al.). Claims 10-12 stand rejected under 35 U.S.C. § 103 as being unpatentable over the Imamura, et al. and Harris, et al. patents in further view of U.S. Patent No. 5,629,804 (Tomono). Applicants traverse these rejections.

As recited in independent Claims 1-4, 7 and 8, Applicants' invention is directed to a diffractive optical element which includes (i) a first diffraction grating and an alignment pattern formed on a first substrate, and (ii) a second diffraction grating and an alignment pattern formed on a second substrate. The gratings are accumulated with an air space therebetween.

As recited in independent Claim 11, Applicants' invention is directed to a method of manufacturing a diffractive optical element. The method includes a step of preparing a mold having (i) an alignment pattern to be engaged with an alignment pattern formed on a substrate having a first diffraction grating pattern, and (ii) a second diffracting grating pattern. The method also includes a step of positioning the first diffraction grating pattern and the second diffraction grating pattern to be spaced with respect to each other, across an air space.

The Imamura, et al. patent is cited in the Office Action as describing gratings 21 and 22 formed with a space therebetween. However, Applicants note that the "space" consists of layer 12, which is formed of glass or polycarbonate. Applicants submit that gratings 21 and 22 do not have an air space therebetween.

The Harris, et al. patent has been cited as describing the use of alignment markings. The Tomono patent has been cited as describing forming diffracting gratings

using a mold. Applicants submit that neither of these patents remedy the deficiency of the Imamura, et al. patent, inasmuch as the patents do not describe providing an air space between diffraction gratings, as claimed herein.

Accordingly, Applicants submit that the Imamura, et al., Harris, et al. and Tomono patents, taken alone or in combination, fail to disclose or suggest at least the features of a first diffraction grating and alignment pattern formed on a first substrate and a second diffraction grating and alignment pattern formed on a second substrate, the first and second gratings being accumulated with an air space therebetween, as recited in independent Claims 1-4, 7 and 8. In addition, Applicants submit that those documents also fail to disclose or suggest at least the steps of (i) preparing a mold having (a) an alignment pattern to be engaged with an alignment pattern formed on a substrate, and (b) a second diffraction grating pattern, and (ii) positioning a first diffraction grating pattern on the substrate and the second diffraction grating pattern to be spaced with respect to each other, across an air space, as recited in independent Claim 11.

For the foregoing reasons, Applicants submit that the independent claims are allowable over the cited documents, and request withdrawal of the rejections under 35 U.S.C. § 103.

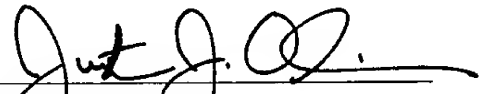
The remaining claims in the present application are dependent claims which depend from the independent claims discussed above, and thus are patentable over the applied documents for reasons noted above with respect to those independent claims. In addition, each recite features of the invention still further distinguishing it from the applied documents. Applicants request favorable and independent consideration thereof.

This Amendment After Final Rejection is an earnest attempt to advance prosecution and is believed to clearly place this application in condition for allowance. At the very least, the Amendment reduces the number of issues on appeal. This Amendment was not earlier presented because Applicants earnestly believed that the prior amendment placed the subject application in condition for allowance. Accordingly, Applicants respectfully request entry of this Amendment under 37 C.F.R. 1.116.

Applicants believe that all outstanding matters in this application have been attended to, and that the application is in condition for allowance. Accordingly, Applicants request a notice thereof.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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VERSIONS WITH MARKINGS TO SHOW
CHANGES MADE TO THE CLAIMS

1. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are [integrally] formed on a first substrate and the second diffraction grating and an alignment pattern are [integrally] formed on a second substrate, and that the first and second gratings are accumulated with [a space] an air space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a largest optical path difference to be applied to light rays passing through the diffraction grating portion with respect to each of plural wavelengths, becomes equal to a multiple, by an integral number, of the corresponding one of the plural wavelengths.

2. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are [integrally] formed on a first substrate and the second diffraction grating and an alignment pattern are [integrally] formed on a second substrate, and that the first and second gratings are accumulated with [a space] an air space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a largest optical path difference to be applied to light rays passing through the diffraction grating portion with respect to each of plural wavelengths becomes equal to a multiple, by an integral number, of the corresponding one of the plural wavelengths, and the alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.

3. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are [integrally] formed on a first substrate and the second diffraction grating and an alignment pattern are [integrally] formed on a second substrate, and that the first and second gratings are accumulated with [a space] an air space therebetween and the first and second diffraction

gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a diffraction efficiency of diffraction light of a particular order, with respect to each of plural wavelengths, becomes equal to or nearly equal to 100%.

4. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are [integrally] formed on a first substrate and the second diffraction grating and an alignment pattern are [integrally] formed on a second substrate, and that the first and second gratings are accumulated with [a space] an air space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate;

wherein the first and second diffraction gratings are formed on different materials such that a diffraction efficiency of diffraction light of a particular order, with respect to each of plural wavelengths, becomes equal to or nearly equal to 100%, and the alignment patterns are formed outside optically effective regions of the first and second diffraction gratings.

5. (Amended) A diffractive optical element according to [any one of Claims 1-4] Claim 1, wherein the first and second diffraction gratings are disposed opposed to each other.

6. (Amended) A diffractive optical element according to [any one of Claims 1-4] Claim 1, wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape.

7. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are [integrally] formed on a first substrate and the second diffraction grating and an alignment pattern are [integrally] formed on a second substrate, and that the first and second gratings are accumulated with [a space] an air space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape.

8. (Amended) A diffractive optical element having a diffraction grating portion which includes first and second diffraction gratings, the improvement residing in that:

the first diffraction grating and an alignment pattern are [integrally] formed on a first substrate and the second diffraction grating and an alignment pattern are [integrally] formed on a second substrate, and that the first and second gratings are accumulated with [a space] an air space therebetween and the first and second diffraction gratings are positioned so that the alignment pattern on the first substrate engages the alignment pattern on the second substrate,

wherein the alignment patterns have a sectional shape of one of a triangular shape, a trapezoidal shape and a semi-circular shape, and the alignment patterns are formed outside optically effective regions of the diffraction gratings.

9. (Amended) A method of manufacturing a diffractive optical element as recited in [any one of Claims 1-4, 7, 8 and 15-20] Claim 1, characterized by a process for fitting the alignment patterns of the first and second substrates together.

10. (Amended) A method of manufacturing a diffractive optical element as recited in [any one of Claims 1-4, 7, 8 and 15-20] Claim 1, characterized by a process in which, after the first substrate is formed, the second substrate is formed by use of a mold, wherein the alignment pattern of the first substrate is fitted into the alignment pattern of the

second substrate formed on the mold for the second substrate, whereby the first and second substrates are mutually positioned and molding of the second substrate is performed.

11. (Amended) A method of manufacturing a diffractive optical element, comprising the steps of:

forming, upon a substrate, a first diffraction grating pattern and an alignment pattern;

preparing a mold having (i) an alignment pattern to be engaged with the alignment pattern formed on the substrate, and (ii) a second diffraction grating pattern; and

positioning the first diffraction grating pattern on the substrate and the second diffraction grating pattern to be spaced with respect to each other, across an air space, by engaging the alignment pattern of the substrate with the alignment pattern of the mold.

13. (Amended) An optical system having a diffractive optical element according to [any one of Claims 1-4, 7 and 8] Claim 1.

14. An optical system having a diffractive optical element as manufactured in accordance with the method recited in Claim 9.